

## **ABSTRACT**

Molds are fabricated having a substrate of high density, high strength ultrafine grained isotropic graphite, and having a mold cavity coated with a refractory metal such as W or Re or a refractory metal carbide such as TaC or HfC . The molds may be made by making the substrate (main body) of high density, high strength ultrafine grained isotropic graphite, by, for example, isostatic or vibrational molding, machining the substrate to form the mold cavity, and coating the mold cavity with titanium carbide via either chemical deposition or plasma assisted chemical vapor deposition, magnetron sputtering or sputtering. The molds may be used to make various metallic alloys such as nickel, cobalt and iron based superalloys, stainless steel alloys, titanium alloys and titanium aluminide alloys into engineering components by melting the alloys in a vacuum or under a low partial pressure of inert gas and subsequently casting the melt in the graphite molds under vacuum or low partial pressure of inert gas.